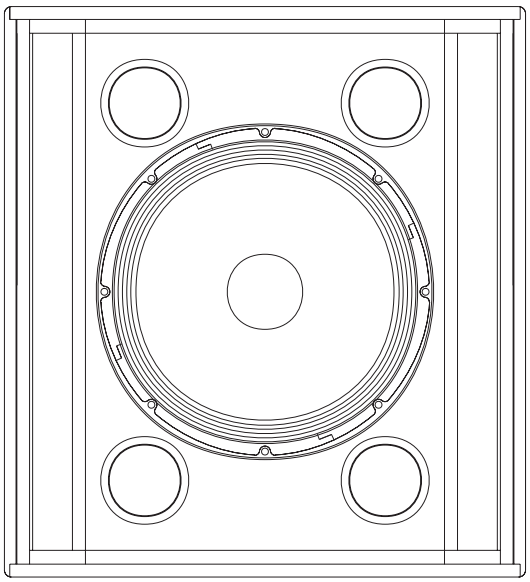
Electro-Voice®

FRX-181

High-Output, Bass System



- **18-inch woofer**
- **Direct-radiator vented-box enclosure**
- **Solid response to 37 Hz**
- **400-watts long-term power capacity**
- **Trapezoidal cabinet matches the footprint of the FRX-640 and FRX-940**
- **Ring-Mode Decoupling (RMD™)**
- **Available in black (BLK) unfinished (UN) and white (WH)**
- **Built-in L-track rigging with fittings included**

Description

The Electro-Voice FRX-181 bass system is a member of the FRX series of fixed-installation speaker systems designed for indoor sound reinforcement applications such as churches, meeting halls, and auditoriums. It provides increased bass output and solid bass extension to 37 Hz for the FRX-640 and FRX-940 two-way, horn-loaded coaxial speaker systems. Because of the direct-radiating woofer in the FRX-181, the system can also be used as a woofer in two- or three-way systems with crossovers as high as 800 Hz, with coverage angles greater than 100° (H) x 100° (V). Capable of producing sound pressure levels (SPL) in excess of 122 dB above 50 Hz at 1 meter, the FRX-181 will give solid bass reproduction from 37 up to 800 Hz. The FRX-181 features a high-excursion DL18MT 18-inch woofer mounted in a 7-ft^3 direct-radiating vented-box enclosure tuned to 40 Hz. The system is available in three finishes: black (BLK), unfinished (UN), and white (WH).

Ring-Mode Decoupling (RMD™)

The FRX-181 controls both acoustical and mechanical ring modes to provide dramatically increased intelligibility, using techniques learned from the development of the Electro-Voice X-Array™ concert speakers. There is much less coloration of the sound from resonating sources, leaving only the intended sound to be heard by the audience.

Frequency Response

The FRX-181's axial frequency response was measured in Electro-Voice's large anechoic chamber at a distance of 3 meters (10 ft.) with a swept sine-wave input, and then referred back to 1 meter with an input of 2.83 V rms (one watt in the rated 8-ohms impedance). The response, shown in Fig. 1, has been smoothed with a 1/10th-octave filter and corrected for chamber low-frequency errors. Referenced to the 100-Hz level, the system is 3-dB down at 43 Hz, 6-dB down at 40 Hz, and 9 dB down at 36 Hz. Except for a moderate 5-dB dip at 600 Hz, the response is quite smooth and flat to above 2 kHz.

Distortion

The swept 2nd- and 3rd-harmonic distortion of the FRX-181 is shown in Fig. 2 for a 1/10th full-power input (40 Watts) over the range of 20 Hz to 7 kHz. All data has been smoothed with a 1/10th-octave filter. Above 35 Hz, the second-harmonic distortion remains below 3%, while the third-harmonic stays below 1.4%.

Impedance

The impedance of the FRX-181 over the range of 20 Hz to 20 kHz is shown in Fig. 3. Impedance minimums of 7.6 Ohms at 40 Hz (the vented-box resonant frequency) and 7.0 Ohms at 140 Hz are exhibited. Impedance peaks of 48 Ohms are reached at 25 and 60 Hz. To limit voltage drive variations at the terminals of the loudspeaker, total cable resistance should be limited to the following values: 1 ohm for maximum peak-to-peak ripple of 1 dB, 0.5 ohms for 0.5-dB ripple, 0.25 ohms for 0.25-dB ripple, etc.

Directivity

The directional characteristics of the FRX-181 were measured in Electro-Voice's large anechoic chamber at a distance of 6 meters (20 feet). The test signal was one-third-octave filtered pink noise at the frequencies indicated. A full spherical measurement system was used.

Figure 4 illustrates the horizontal and vertical polar responses of the FRX-181 over the range of 50 Hz to 2 kHz. Figure 5 shows the corresponding horizontal and vertical beamwidths. Beamwidth is the angle at which the horizontal and vertical polar responses have decreased by 6 dB when

compared to the on-axis level (0°). At 800 Hz and below, the beamwidth remains above 100° in both horizontal and vertical directions. Above 1kHz, the response in both directions narrows to 50° at 2 kHz. Some polar widening is evident at 630 Hz.

The directivity factor (Q) and directivity index (D_i) of the FRX-181 are shown in Fig. 6. The directivity factor (Q) is the relative value, at a point, of the FRX-181 output when compared to an ideal spherical response. The directivity index (D_i) in dB is calculated by $D_i = 10 \text{ Log}_{10} Q$.

Power-Handling Test

Electro-Voice components and systems are manufactured to exacting standards, ensuring they will hold up, not only through the most rigorous of power tests, but also through continued use in arduous, real-life conditions. The EIA Loudspeaker Power Rating Full Range (EIA RS-426-A 1980) uses a noise spectrum which mimics typical music and tests the thermal and mechanical capabilities of the components. Electro-Voice will support relevant additional standards as they become available. Extreme, in-house power tests, which push the performance boundaries of the system, are also performed and passed to ensure years of trouble-free service.

Specifically, the FRX-181 passes EIA RS-426-A 1980 with the following values:

$R_{SR} = (1.15 \times R_E) = 6.9$ ohms
$P_{E(MAX)} = 400$ watts
Test voltage = 52.5 volts rms,
105 volts peak
(+6 dB)

The "peak" power-handling capacity of a woofer is determined by the peak test voltage amount. For the FRX-181 a 105-volt peak test voltage translates into a 1,600-watt short-term-peak power-handling capacity. This is the equivalent of four times the "average" power-handling capacity, and is a peak that can be sustained for only a few milliseconds. However, this sort of short duration peak is very typical in speech and music. Provided the amplifier can reproduce the signal accurately, without clipping, the system will also perform accurately and reliably, even at these levels.

Sub-passband Speaker Protection

Below the FRX-181 enclosure's 40Hz tuning frequency cone excursion increases rapidly. Since acoustic output is also falling rapidly, there is no utility in driving the system with signals much below tuning frequency. While such signals may be in the program material, they are often extraneous, such as a dropped microphone.

For maximum protection, the FRX-181 should be high-passed at 32 to 40 Hz with a second- or higher-order high-pass filter.

Continuously variable high-pass protection is typically provided by digital speaker processors, examples of which are the Electro-Voice Dx38, Klark Teknik DN8000 and Merlin® ISP-100. Also, the Electro-Voice Ex23 and XEQ-2 analog electronic crossover/equalizers provide subpassband protection. The 3-dB-down points are 30 Hz.

Other high-pass filters are available and one-third-octave equalizers can also be effective at providing the required protection.

Suspending the FRX-181

The quick-release, aircraft-rated heavy-duty L-track-type hardware design allows arrays of loudspeakers to be assembled very quickly, and offers such flexibility in the vertical angling of cabinets that pull-up points are usually unnecessary. However, if the need for pull-up points is required, two 3/8-16 threaded nuts are located on the rear of enclosure for this purpose. One eyebolt is included for pull-up use.

Additional flying hardware is installed on the bottom of the enclosure for arraying purposes. However, a maximum of two FRX enclosures (304 lb max.) can be "daisy-chained" together, allowing the construction of vertical arrays. If longer arrays are required, or for loads exceeding the 304-lb maximum load limit, provision must be made to independently suspend each enclosure.

Four fittings are included in the system packaging. Contact the following to purchase additional fittings:

Ancra International, 3300 Turfway Rd., Erlanger, KY 41018, 800/233-5138 or Sound Manufacturing, 3336 Primera Ave., Hollywood, CA 90068-1550, 231/850-5042

Suspending an object is potentially dangerous and should only be attemped by individuals who have a thorough knowledge of the techniques and regulations of rigging objects overhead. It is the responsibility of the installer to ensure the FRX-181 is safely installed in accordance with applicable regulations. If the FRX-181 is suspended, Electro-Voice strongly recommends that the system be inspected at least once a year. If any sign of weakness or damage is detected, remedial action should be taken immediately.

Electrical Connections

The FRX-181's rear connection panel contains a pair of heavy-duty two-terminal barrier terminal strips which are connected in parallel. Either upper or lower terminal strip can be used for input connections. The remaining strip can be used as a convenient connection point for adding multiple paralleled FRX-181 woofers. We recommend parallel connections of only two or three FRX-181 systems maximum. These combinations results in quite-low minimum impedances of 3.5 and 2.3 Ohms respectively. Check your power amplifier's minimum impedance specifications to see if these loads can be driven properly.

Architects' and Engineers' Specifications

The loudspeaker system shall be a 7-ft^3 direct-radiating vented-box system housing an 18-inch woofer, with a usable frequency response from 37 Hz to 1 kHz. The speaker shall be tuned to 40 Hz with the use of four circular vent tubes mounted on the front panel. The loudspeaker shall meet the following performance criteria: Power handling: 400 Watts, based upon ANSI/EIA RS-426-A 1980 Standard; frequency response: smooth and usable at high SPL from 37 Hz to 1 kHz; 2.83 Vrms sensitivity: 96 dB averaged from 50 to 400 Hz; impedance: 8-ohms nominal, 7-ohms minimum. The system shall have a distribution pattern that is no less than 100° horizontal and 100° vertical (at the 6-dB down points from on axis) up to 800 Hz. The enclosure

shall be constructed of plywood and braced appropriately, and the grille will be constructed from powder-coated steel, backed by a weather-resistant foam. The dimensions shall be 78.7 cm (31.0 in.) high by 71.9 cm (28.3 in.) wide by 66.0 cm (26.0 in.) deep. Net weight shall be 45.5 kg (100 lb).

The system shall be the Electro-Voice FRX-181 BLK (black texturlac paint with black grille), or the FRX-181 UN (unfinished ready for staining with black grille), or the FRX-181 WH (white texturlac paint with white grille).

Limited Warranty

Electro-Voice products are guaranteed against malfunction due to defects in materials or workmanship for a specified period, as noted in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual, beginning with the date of original purchase. If such malfunction occurs during the specified period, the product will be repaired or replaced (at our option) without charge. The product will be returned to the customer prepaid. **Exclusions and Limitations:** The Limited Warranty does not apply to: (a) exterior finish or appearance; (b) certain specific items described in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual; (c) malfunction resulting from use or operation of the product other than as specified in the product data sheet or owner's manual; (d) malfunction resulting from misuse or abuse of the product; or (e) malfunction occurring at any time after repairs have been made to the product by anyone other than Electro-Voice Service or any of its authorized service representatives. **Obtaining Warranty Service:** To obtain warranty service, a customer must deliver the product, prepaid, to Electro-Voice Service or any of its authorized service representatives together with proof of purchase of the product in the form of a bill of sale or receipted invoice. A list of authorized service representatives is available from Electro-Voice Service at 600 Cecil Street, Buchanan, MI 49107 (800/234-6831 or FAX 616/695-4743)**. Incidental and Consequential Damages Excluded:** Product repair or replacement and return to the customer are the only remedies provided to the customer. Electro-Voice shall not be liable for any incidental or consequential damages including, without limitation, injury to persons or property or loss of use. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **Other Rights:** This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Electro-Voice Speakers and Speaker Systems are guaranteed against malfunction due to defects in materials or workmanship for a period of five (5) years from the date of original purchase. The Limited Warranty does not apply to burned voice coils or malfunctions such as cone and/or coil damage resulting from improperly designed enclosures. Electro-Voice active electronics associated with the speaker systems are guaranteed for three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

For warranty repair or service information, contact the service repair department at: 616/695-6831 or 800/685-2606.

For technical assistance, contact Technical Support at 800/234-6831 or 616/695-6831, M-F, 8:00 a.m. to 5:00 p.m. Eastern Standard Time.

Specifications subject to change without notice.

Figure 1— Axial Frequency Response (anechoic environment, 1 Watt at 1 meter).

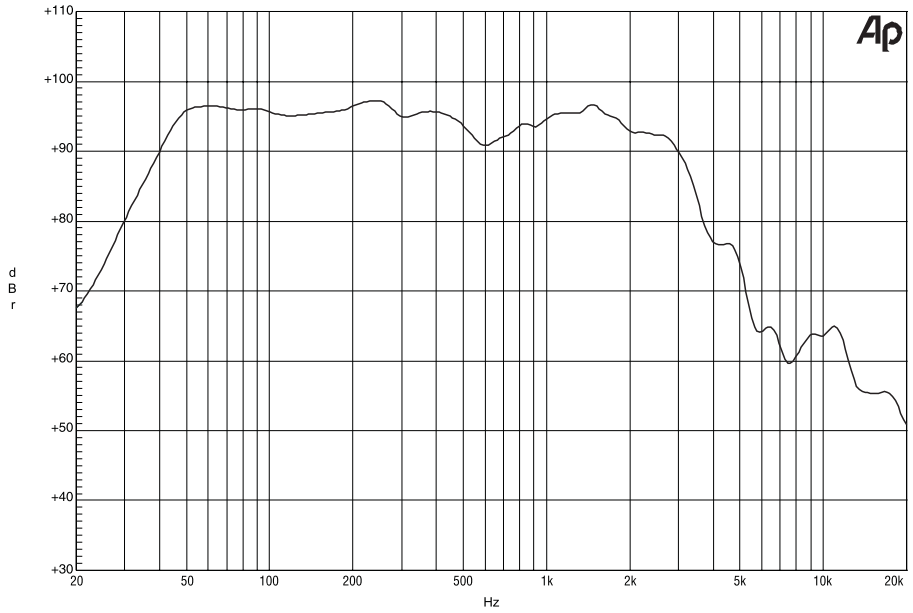


Figure 2—Harmonic Distortion, 1/10th Rated Power Input (anechoic environment, 40 Watts at 1 meter).

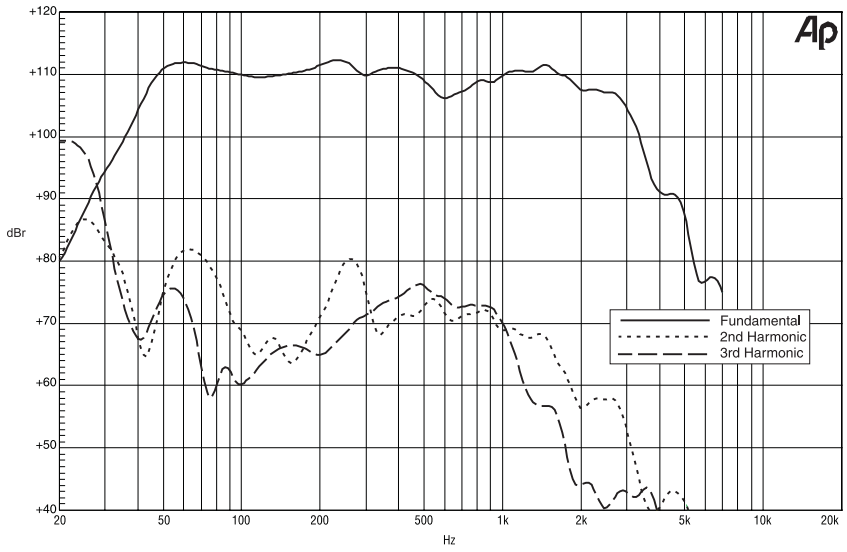


Figure 3—Impedance vs. Frequency (anechoic environment, log scales).

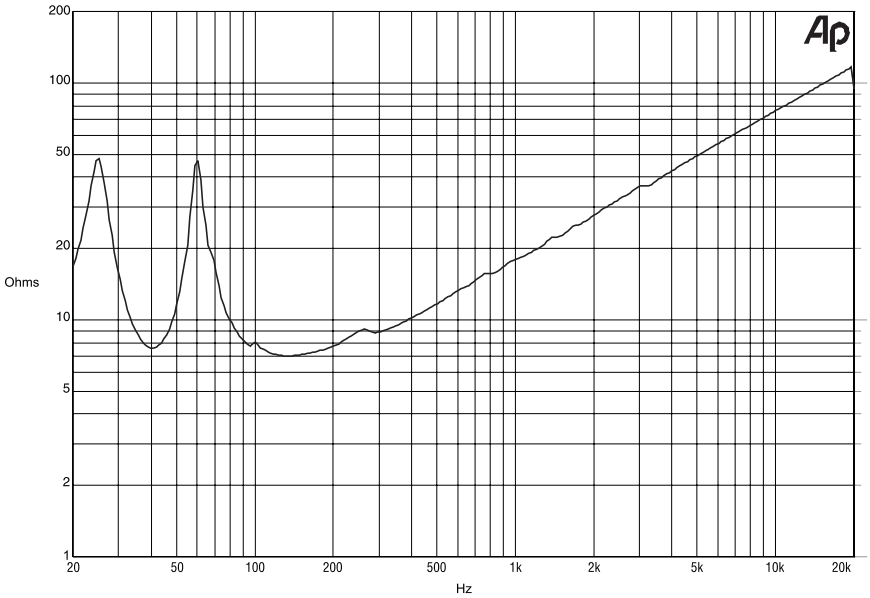
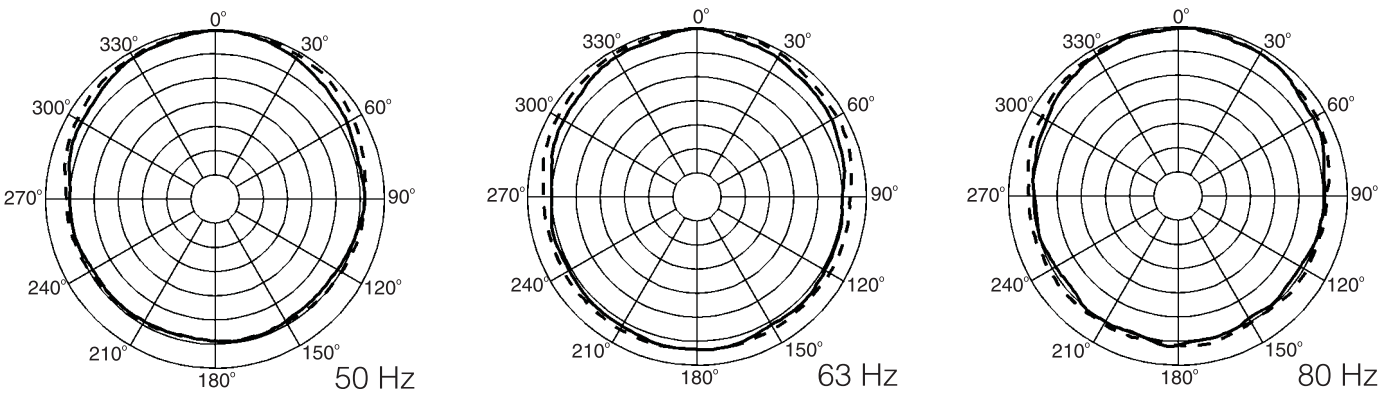


Figure 4—Horizontal and Vertical One-Third-Octave Polar Responses vs Frequency (anechoic environment, 6 meters, long box axis vertical).



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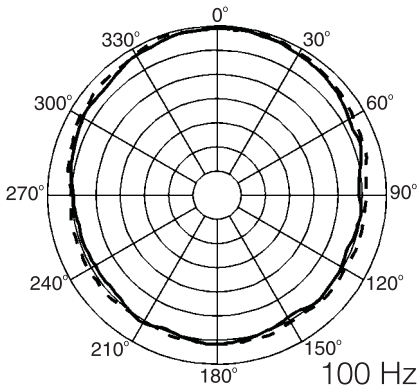
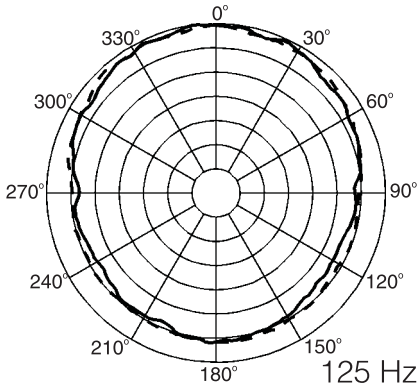
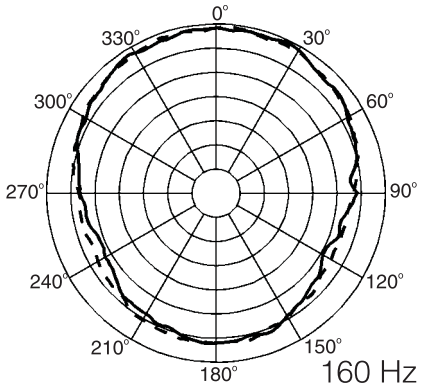
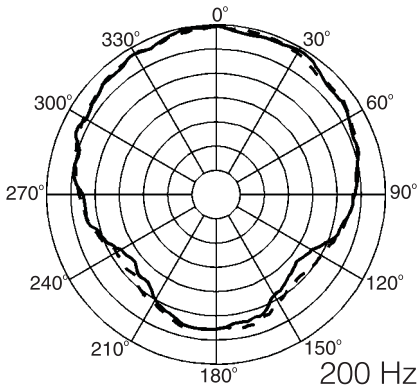
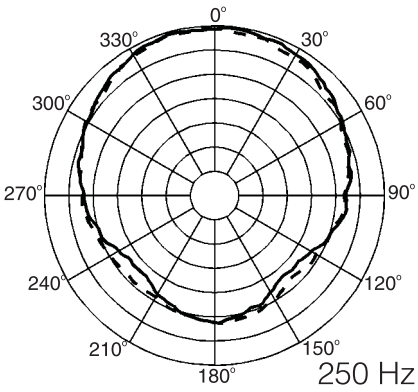
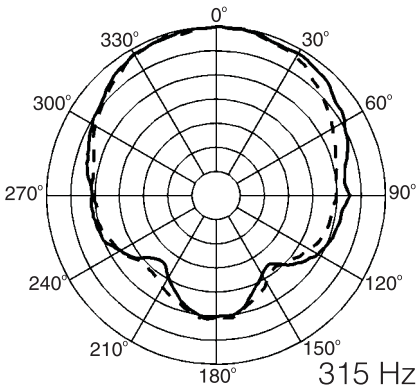


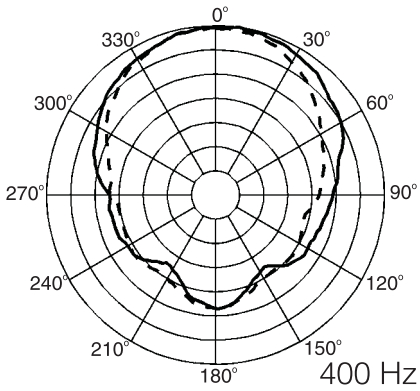


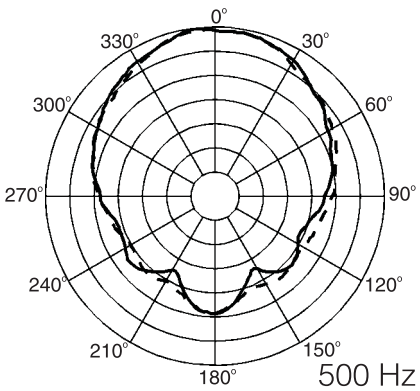


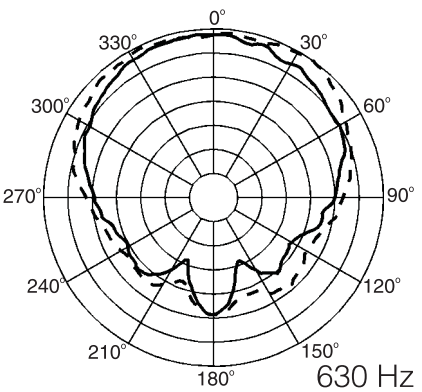


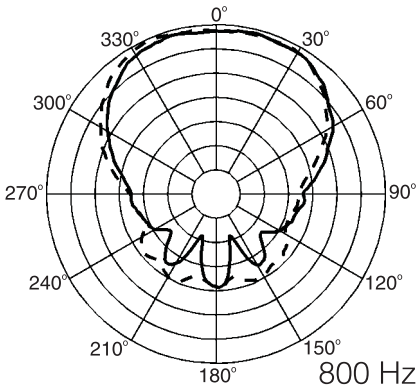


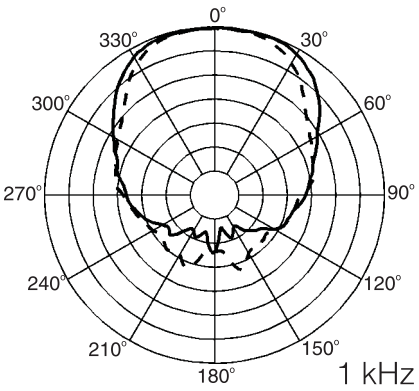


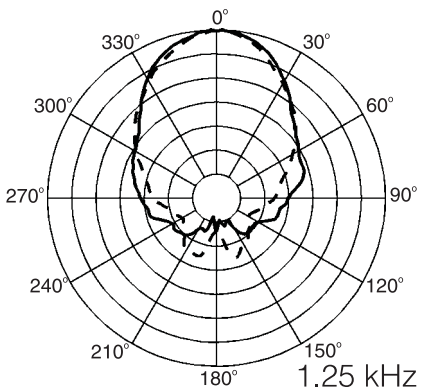


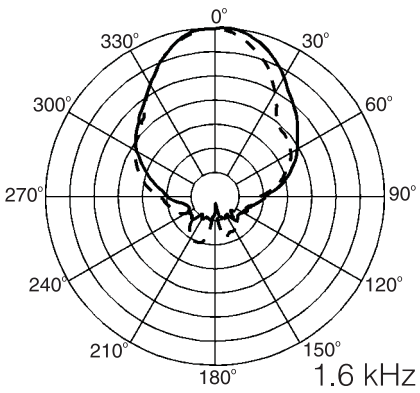












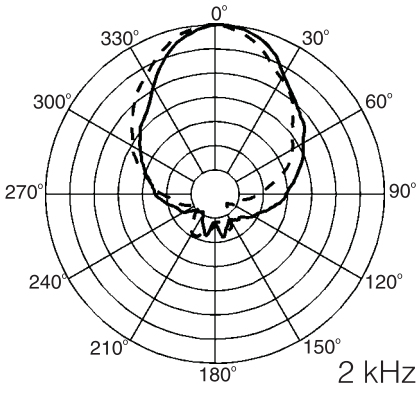


Figure 5—Beamwidth vs. Frequency (anechoic environment, 6 meters).

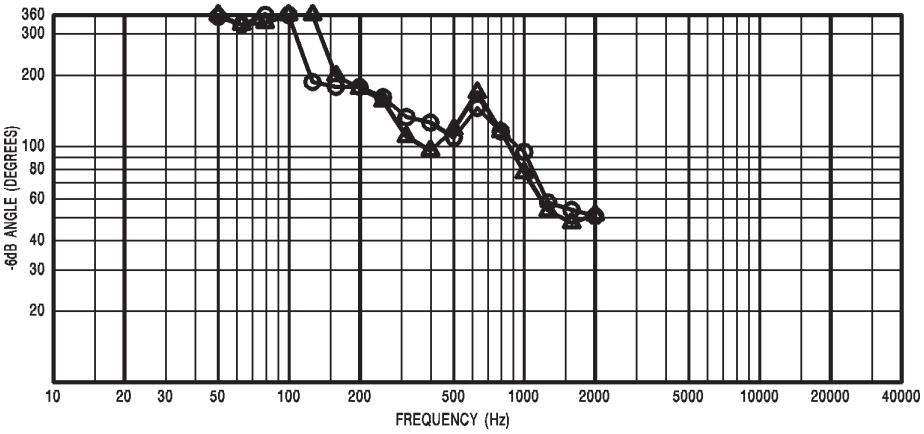


Figure 6—Directivity vs. Frequency (anechoic environment, 6 meters).

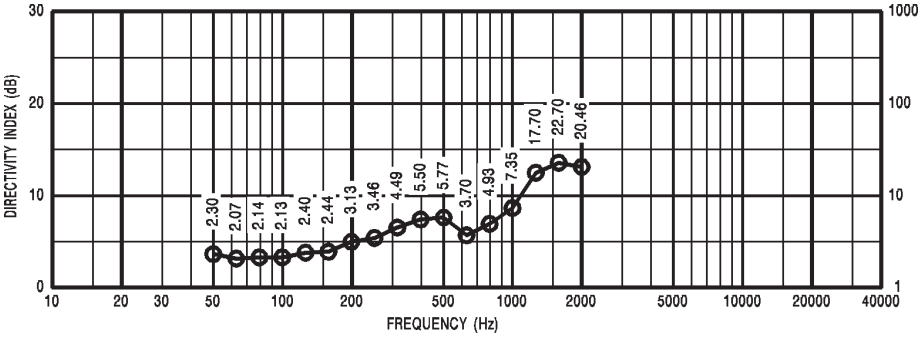
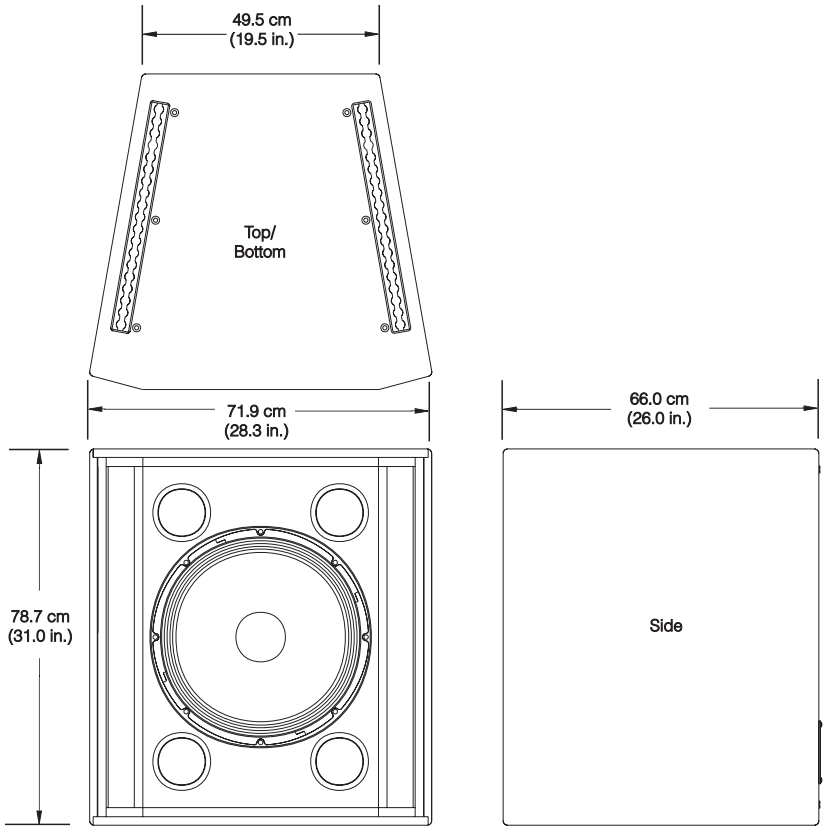


Figure 7—FRX-181 Dimensions



FRX-181 High-Output, Bass Speaker System

Specifications

Axial Frequency Response (swept sine wave, 4 volts at 10 feet on axis, anechoic environment normalized for 1 watt/1 meter; see Figure 1):
37-1,000 Hz

Low-Frequency 3-dB-Down Point:
43 Hz

Usable Low-Frequency Limit (10-dB-down point):
35 Hz

Half-Space Reference Efficiency:
2.9%

Long-Term Average Power-Handling Capacity (per ANSI/EIA RS-426-A 1980; see Power-Handling Capacity section):
400 watts

Maximum Woofer Acoustic Output:
11.6 watts

Sensitivity (SPL at 1 m, 1 W into nominal impedance, anechoic environment, band-limited pink-noise signal, 50-300 Hz):
96 dB

Beamwidth (angle included by 6-dB-down points on polar responses, horizontal and vertical planes, indicated one-third-octave bands of pink noise; see Figure 5):

50-800 Hz:
Equal or greater than 100° in both horizontal and vertical planes, widening as frequency decreases,

1,000-2,000 Hz:
Narrows to about 50° in both planes at 1,250 Hz and above.

Directivity (see Figure 6):

Average 50-200 Hz:
Factor (Q): 2.4
Index (D_i): 3.8 dB

Average 250-800 Hz:
Factor (Q): 4.6
Index (D_i): 6.6 dB

Average 1,000-2,000 Hz:
Factor (Q): 17.1
Index (D_i): 12.3 dB

Transducer Complement,

Low-Frequency:
DL18MT 18-inch woofer

Box Tuning Frequency:
40 Hz

Impedance,

Nominal:
8 ohms

Minimum:
7.0 ohms

Input Connections:
Dual barrier strip with screw terminals
1+/1–, 1+/1- paralleled

Enclosure Materials and Colors:
Seven-ply plywood with removable grille

FRX-181 BLK
Black textured paint, black grille

FRX-181 UN
Unfinished (ready to stain), black grille

FRX-181 WH
White textured paint, white grille

Grille:
Powder-coated steel backed with foam

Suspension: See suspending the FRX-640 section
Two-point heavy-duty L-track system, accepts New Haven NH32102-2 double-stud fittings, New Haven NH8192-2S or Ancra 42546-10 single-stud fittings with safety pins (four Anera 42546-10 fittings and one 3/8"-16 forged eyebolt included)

Contact the following to purchase additional fittings:

Ancra International
3300 Turfway Rd.
Erlanger, KY 41018
800/233-5138

or

Sound Manufacturing, Inc.
3336 Primera Ave.
Hollywood, CA 90068-1550
909/878-9104

Dimensions,

Height:
78.7 cm (31.0 in.)

Width:
71.9 cm (28.3 in.)

Depth:
66.0 cm (26.0 in.)

Net Weight:
45.5 kg (100 lb)

Shipping Weight:
47.7 kg (105 lb)

Electro-Voice®
600 Cecil Street, Buchanan, MI 49107
616/695-6831, 616/695-1304 Fax

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